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371

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R001135510001-4"

MOYZHES, B. Ya.

Moizes, B. Ya. The computation for some grid structures. Akad. Nauk SSSR. Žurnal Tehn. Fiz. 20, 716–726 (1950). (Russian)

The reflection of plane electromagnetic waves by a plane array of thin closely spaced conducting wires is studied and the results obtained are used to get the reflection coefficient of such a grid as an obstacle in a wave guide. A spherical cavity resonator with walls consisting of closely spaced circular loops of wire is considered next and the attenuation constants of its normal modes are found. Finally a computation is made of the attenuation constant of waves in a cylindrical wave guide with grid wires for walls.

E. N. Gilbert (Murray Hill, N. J.).

Source: Mathematical Reviews, Vol 12 No. 9

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

3RD AND 4TH ORDERS

COMMON ELEMENTS

WG

General Physics

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538.561

The Problem of the Excitation of Electromagnetic Oscillations. B. Ya. Moyzhes. (*Zh. tekh. Fiz.*, June 1950, Vol. 20, No. 6, pp. 698-715.) A general method has been recently proposed by G. A. Grinberg (Selected Problems of the Mathematical Theory of Electric and Magnetic Phenomena, published by the Academy of Sciences of U.S.S.R., 1948) for solving a large group of problems in connection with the excitation of waveguides and other systems by a given distribution of currents or by slots for which the tangential component of the electric field is known. In this method one or, more generally, two independent equations are derived from Maxwell's equation. Each of these equations includes a scalar function (field component or a component of auxiliary function potentials) for which the boundary conditions have to be established separately. In the present paper this method is discussed in detail and applied to the cases of a cylindrical waveguide and a sectoral horn.

MATERIALS INDEX

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

USSR/Physics - Electrodynamic averaging FD-2416

Card 1/2 Pub. 153-20/21

Author : Moyzhes, B. Ya.

Title : Electrodynamic averaged boundary conditions for metal networks

Periodical : Zhur. tekh. fiz. 25, 158-166, Jan 1955

Abstract : Up to the present very little has been published on nonelectrostatic fields created by networks. The problem of the reflection of a plane wave from a plane grid consisting of parallel conductors has been solved by integral equations (Spravochnik po volnovodam [Handbook on waveguides], Ya. N. Fel'd, editor, Soviet Radio Press, 1952); M. I. Kontorovich gave a more general approach to the calculation of electrodynamic fields in systems with grids in which he considered the screening action of a spherical grid consisting of parallel conductors and plane counterweight made of a grid consisting of intersecting conductors (ZhTF, 9, 1939; "Use of method of averaging of fields in study of certain electrical systems," Doctoral Dissertation, Leningrad Polytechnic Institute, 19[illegible]). In the present article the writer gives a general derivation of the electrodynamic boundary conditions on the surface of a

Card 2/2 FD-2416

grid, and presents an application of them (e.g. considers the reflection of a plane wave from a homogeneous plane network, and also considers the screening action of aspherical network of radius R relative to small screw current arranged in the center of the network). Five references.

Institution: --

Submitted : March 5, 1954

USSR/Physics - Electrostatic averaging FD-2417

Card 1/1 Pub. 153-21/21

Author : Moyzhes, B. Ya.

Title : Electrostatic averaged boundary conditions for metal networks

Periodical : Zhur. tekh. fiz. 25, 167-176, Jan 1955

Abstract : The more general approach to the calculation of the fields in systems containing grids has been given by V. S. Lukoshkov (ibid. 6, 1936; Izv. AN SSSR, ser. fiz. 8, 1944) and M. I. Kontorovich (Doctoral Disserta-tion, 1940), both making extensive use of the expression for the acting potential in a plane triode with grid consisting of parallel conductors, obtained by conformal representation. In the present article the writer gives a general derivation of the boundary condition for a network (grid) by the method of averaging of the field, and presents an application of the boundary condition (e.g. screening action of a grounded homogeneous spherical grid of radius R relative to charge Q located at the center of the sphere). Seven references: e.g. B. M. Tsarev, Raschet i konstruiro-vaniye elektronnykh lamp [Calculation and design of electron tubes], State Power Press, 1952.

Institution: --

Submitted : March 5, 1954

Žurn. techn. fis, 26, fasc. 8, 1836-1840 (1956) CARD 2 / 2 PA - 1278

CARD 1 / 2 PA - 1278

SUBJECT USSR / PHYSICS
AUTHOR MOIZES, B.JA.
TITLE On the Problem concerning the Form of Trajectories of Electrons in the Magnetron in the Static Case.
PERIODICAL Žurn. techn. fis, 26, fasc. 8, 1836-1840 (1956)
Publ. 8 / 1956 reviewed 9 / 1956

In a magnetic field that is larger than the so-called critical one, the trajectories of electrons have a different character which depends on the position of the electrodes. In the case of a concave electrode the electrons return to the cathode, and in the case of a convex electrode they move along concentrical circles (Brillouin state). The task of determining the motion of electrons in a flat magnetron with respect to space charge was performed by BRAUDE. It turned out, however, that in a magnetic field that is larger than the critical one, the velocities and the accelerations of the electrons which are directed from the cathode to the anode at the same time become equal to zero at the point of return. The question as to whether the electrons on this occasion return to the cathode or whether in this case the character of the motion changes entirely remained unanswered. A cylindrical magnetron with a ratio between anode radius and cathode radius of about 1 : 1 was examined. The task was solved by means of the oscillation method.

PA - 2179

AUTHOR: MOYZHES, B.YA.

TITLE: The Electrostatic Field of a Conducting Plane Square Lattice. (Elektostaticheskoye pole provolochnoy setki s kvadratnym yacheykani, Russian)

PERIODICAL: Zhurnal Tekhn.Fiz. 1957, Vol 27, Nr 1, pp 147-155 (U.S.S.R.)
Received: 2 / 1957 Reviewed: 4 / 1957

ABSTRACT: In the here discussed approximated solution of this problem the charges distributed over the surface of the conductors are replaced by charged threads (which are thought to be in the axes of the conductors). The charge density along the wires is selected in such a manner that the potential on the generatrix of the conductors lying above and below the lattice (z=+a) is equal. In the case of thin conductors the potential produced on the charged wires changes only to a small extent in the case of transition from the generatrix z=+a to other generatrices of the cylinder. The greatest modifications of the potential have to occur in the central plane (z=0) in the proximity of the nodes. Here the equipotential surface deviates from the surface of the conductors by about 0,4 conductor radii as numerical calculations show. The fact, however, that in the case of real lattices the conductors lie one on top of the other in the nodes and can be soldered, has to be taken into account. Therefore the system of charged threads in the case of a ≪ b can approach the real lattice to approximately the

Card 1/2

PA - 2179

The Electrostatic Field of a Conducting Plane Square Lattice.

same extent as a system of intersecting cylinders. Here a denotes the radius of the conductor and b the half-distance (from center to center) between the quadratically arranged conductors. The integral equation for the solution of this problem and an ansatz for its solution are given. For the development of the FOURIER coefficients either side of the integral equation is developed in FOURIER series and the coefficients of the corresponding terms are compared. The problem of charge distribution on the threads is reduced by this fact to the solution of an infinite system of equations. The finally found expression for the potential outside the lattice is explicitly written down. The determination of the FOURIER coefficients is then discussed step by step. The charge distribution found by the present paper is not a solution of the potential problem for a lattice consisting of intersecting cylinders, but for a lattice with even transitions and nodes in the plane $z = 0$, where the equipotential surface deviates by a distance of approximatively 0,4 conductor radii from the surface of the cylinder. (1 illustration).

ASSOCIATION: Institute for Semiconductors of the Academy of Science of the U.S.S.R., Leningrad

PRESENTED BY:

SUBMITTED: 10.5.1956

AVAILABLE: Library of Congress

Card 2/2

MOYZHES, B. Ya.

PA - 2538

AUTHOR: MOYZHES, B.Ya.

TITLE: Calculation of the Voltage by Photomagnetic Kikoin-Noskov and Dember-Effect under Strong Magnetic Fields. (Raschet napryazheniya pri fotomagnitnom effekte Kikoina - Noskova i Dember-effekte v sil'nykh magnitnykh polyakh, Russian).

PERIODICAL: Zhurnal Tekhn. Fiz., 1957, Vol 27, Nr 3, pp 495 - 501 (U.S.S.R.)
Received: 4 / 1957 Reviewed: 5 / 1957

ABSTRACT: In previous papers by Moss and other authors the fact was neglected that the electrostatic voltage of the electric field has to be a vortex-free vector. Here once more the question of voltage in the case of a photomagnetic effect is investigated as well as that of the influence of a magnetic transverse-field on the Dember-effect. The initial equations for the densities of the electron i_1 and of the hole i_2 - current is written down and it is assumed that relaxation-time does not depend on energy (ion-semiconductor). A system of equations for the components of the electric field E_x and E_y is obtained as well as for / n small concentration-difference between the illuminated and the dark side of the sample). The equation for the voltage of the Dember-effect is then written down and first the voltage in a short circuited electron-semiconductor sample in the case of weak illumination is investigated. It is shown that the voltage of the Dember-effect changes the sign and then tends towards saturation. In a similar manner

Card 1/2

Moyzhes, B. Ya.

57-27-7-6/40

AUTHORS: Moyzhes, B. Ya., Obraztsov, Yu. N.

TITLE: On the Theory of the Transversal Photomagnetic Effect (K teorii poperechnogo fotomagnitnogo effekta)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1957, Vol. 27, Nr 7, pp. [illegible] (USSR)

ABSTRACT: The field voltage and the short-circuit current of the transversal photomagnetic effect discovered in 1934 by Kikoin and Noskov and described in 1956 in Doklady AN SSSR, 109, 735 is calculated here. The attempt is made to explain the formation of this effect and the different course of the curves for n- and p-germanium. A hole-semiconductor is assumed and it is also assumed that the relaxation time does not depend on the energy. This leads to much simpler formulas. The formulae for the field voltage are derived for the ordinary (E_y) photomagnetic effect, for the transversal photomagnetic effect (E_z) and for the voltage of the Dember effect V_x. From the second formula may be seen that in a weak magnetic field the transversal effect is proportional to H^2 (magnetic field [illegible]). In a very strong magnetic field it tends toward a constant. The dependence of the angle on the field direction is due to the multiplicand $H \sin 2\theta$. N-electron-concentration on the illuminated surface. θ - inclination angle of the magnetic field to the

Card 1/2

57-27-7-6/40

On the Theory of the Transversal Photomagnetic Effect

surface of the plate. This formula obtained here for E_z is in contradiction to the test results obtained by Kikoin and Bykovskiy (Doklady AN SSSR, 1956, 109, 735), where upon enlargement of the magnetic field a change of sign of E_z was observed in the case of p-germanium. It is shown that in the case of a degeneration of the hole-zones, in case that two types of holes (rapid and slow ones) are present, the effect-sign in a hole-sample may change when H increases. There are 2 figures and 6 references, 4 of which are Soviet.

ASSOCIATION: Institute for Semiconductors AS USSR, Leningrad (Institut poluprovodnikov AN SSSR, Leningrad)

SUBMITTED: December 29, 1956

AVAILABLE: Library of Congress

1. Semiconductors-Photomagnetic effect-Mathematical analysis
2. Photomagnetic effects-Theory 3. Germanium-Applications

Card 2/2

AUTHOR: Moyzhes, B. Ya. 57-23-6-24/34

TITLE: On the Theory of the Propagation of Electromagnetic Waves in a Spiral (K teorii rasprostraneniya elektromagnitnykh voln v spirali)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 6, pp. 1286 - 1292 (USSR)

ABSTRACT: Usually the spiral is replaced by a surface with infinitely high conductivity in the directions of the windings ($E_{\parallel} = 0$). In the present work the average value $E_{\parallel} \neq C$ is put into relation with the average density of the current on the spiral. The phase velocity of the slow wave in the spiral (the correction as to the ordinary formula is insignificant), as well as the dying-down of the basic wave TE_{01} in a hollow conductor with one spiral was calculated. Also the boundary conditions for the lattice near the well-conducting surface were determined. The formula (7)

Card 1/4

$$(ap)^2 ctg^2\psi = (\xi a)^2 \frac{I(\xi a)\; K(\xi a)}{I_1(\xi a)\; K_1(\xi a)} \cdot \frac{1 + \frac{\gamma}{a}\frac{(ap)^2 \sin^2\psi}{(a\xi)^2 I_0(\xi a)K_0(\xi a)}\left(ctg^2\psi - \frac{(a\xi)^2}{(ap)}\right)}{1 - \frac{\gamma}{a}\frac{\sin^2\psi}{I_1(\xi a)K_1(\xi a)}\left(ctg^2\psi - \frac{(a\xi)^2}{(ap)^2}\right)}$$

explains why the usual approximation of the ideally conductive cylinder leads to a very good agreement between calculated and measured phase velocity. The formula (7) holds as long as the phase shift between the currents in the two adjoining windings is not great, $(2\ ba \ll 1)$, i. e. it extends to only part of the domain of the spiral in the travelling wave tube. The averaged boundary condition (2)

$$E_\tau = ip\eta\left\{\beta j_s + \frac{\gamma}{p^2}\, \mathrm{grad\ div}\ j_s\right\} =$$

$$= ip\eta\left\{\beta\left[H_\tau^{(1)} - H_\tau^{(2)},\ n_0\right] + \frac{\gamma}{p^2}\, \mathrm{grad\ div}\left[H_\tau^{(1)} - H_\tau^{(2)},\ n_0\right]\right\}$$

is justified if there are other bodies in a sufficient distance from the lattice so that the inhomogeneities connected with the periodicity of the lattice cells do not reach them. This postulate is, in practice, satisfied if the other bodies are located at a greater distance Δ than the linear measurements of the lattice cell 2b. If $\Delta > 2b$, the problem can be solved in the usual manner, by connection of the solutions for different domains by means of boundary conditions. From the formula (15)

$$x_{1o} = \frac{1}{a\delta_{m.}\sigma_{m.}\eta} \frac{(\lambda/\lambda_{o1})^2}{1 - (\lambda/\lambda_{o1})^2}$$

it may be seen that the dying-down of the wave TE_{o1} (as well as phase distortion) is reduced rapidly with an increase of the radius of the tube. If the conductivity of the material from which the walls are made is sufficiently good, dying-down in a round hollow conductor with a spiral can be represented in the following form of (16)

On the Theory of the Propagation of Electromagnetic Waves in a Spiral 57-28-6-24/34

$$x_{mn} = x_{mn}^{(o)} \left(\frac{H_{\parallel}^{(2)}}{H^2} + \frac{H_{\perp}^2}{H^2} s^2\right) + x_{mn}^{(s.)}.$$

In order to prevent walls made from material of low conductivity from causing additional dying-down, the condition

$$|s| < \sqrt{\frac{\delta_{s.}}{\delta_{m.}}}$$

must be satisfied. If $\Delta \ll \delta_{m.}$, $\frac{b}{c} \simeq 3$: $b < 7\sqrt{\delta_{s.}\,\delta_{m.}}$ is obtained with $\Delta \ll \delta_{m.}$

There are 2 figures and 9 references, 6 of which are Soviet.

ASSOCIATION: Institut poluprovodnikov, Leningrad (Leningrad Institute for Semiconductors)

SUBMITTED: March 11, 1957

Card 4/4

1. Electromagnetic waves--Propagation 2. Electromagnetic waves--Mathematical analysis

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R001135510001-4"

MOYZHES, B.Ya.

Influence of the surface and volume recombination on a and the back current of a colleter in fused crystal triodes. Zhur. tekh. fiz. 28 no.11:2402-2409 N '58. (MIRA 12:1)
(Triodes)

DEVYATKOVA, Ye.D.; MOYZHES, B.Ya.; SMIRNOV, I.A.

Thermal conductivity of tellurium with various concentrations of impurities in the temperature interval 80 - 480°K. Fiz. tver. tela 1 no.4:613-627 '59. (MIRA 12:6)

1. Institut poluprovodnikov, Leningrad.
(Tellurium--Thermal properties)

24.2600
24.7700
~~9~~ (6)

67308

AUTHOR: Moyzhes, B. Ya. SOV/181-1-8-13/32

TITLE: Elimination of the Edge Effect in the Measurement of the Photomagnetic Electromotive Force in Semiconductors

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 8, pp 1239 - 1242 (USSR)

ABSTRACT: The author conveniently investigated a p-type semiconductor with the equilibrium concentration p_0, in which a certain electron density ($n \ll p_0$) is induced by illumination. In recent years the photomagnetic effect discovered by I. K. Kikoin and M. M. Noskov (Ref 1) in 1934 has found wide application in the measurement of lifetime and rate of surface recombination of semiconductors. In theory, the problem is generally solved for an infinitely large, uniformly illuminated plate where concentration and amperage depend only on the coordinate x. The question is now: which corrections allow to adapt the theoretical formulas to the experimental conditions, and under which conditions will these corrections be small? The two-dimensional problem for a uniformly illuminated plate has already earlier been solved by G. M. Guro (Ref 4). The author first assumes

Card 1/4

4

Elimination of the Edge Effect in the Measurement of the Photomagnetic Electromotive Force in Semiconductors SOV/181-1-8-13/32

that the plate be infinite and a certain range be illuminated. After some operations the relation

$$V_y = \int E_y d_y \frac{D_1'(H_1'+H_2')\int(N_1-N_2)dy}{p_o \mu_2' \, a(1+H_2'^2)}$$

is obtained for the voltage of the photomagnetic effect, where $N_1 \equiv n(0,y)$ and $N_2 \equiv n(a,y)$ denote the electron density on the illuminated and the dark side of the sample, respectively. Index 1 refers to the electrons, and index 2 to the holes; μ denotes mobility, N_1 and N_2 are to be determined by solving the diffusion equation in consideration of boundary conditions. It is further found that $\int(N_1 - N_2)dy = l[n(0) - n(a)]$, where $n(0)$ and $n(a)$ denote the well-known solutions of the one-dimensional problem. If, then, only part of the plate surface is illuminated and the contacts are sufficiently far from the illuminated part, no corrections whatever for the effects produced by the finite dimensions of the plate need be added to the usual formulas for the emf of the photomagnetic effect. It is only necessary to multiply all

Card 2/4

67308

Elimination of the Edge Effect in the Measurement of the Photomagnetic Electromotive Force in Semiconductors SOV/181-1-8-13/32

quantities by width l of the illuminated part. This conclusion is confirmed just as well by experiment. The contacts must be at least some diffusion lengths far from the illuminated surface part in order that recombination and photoelectromotive force do not occur on its surface. Besides, they should be positioned in that part of the sample in which there is no electric field. In order to avoid substitution of corrections into the expression for the photomagnetic emf obtained for the one-dimensional case, the illuminated part of the plate must be at least some diffusion lengths plus some thicknesses far from the contacts and the edges of the plate. If a metallic coating is applied to the front surfaces of the plates and the magnetic field is weak ($\mu H/c \ll 1$), the distance between the contacts and the illuminated part is not related to the sample thickness. Accordingly, the distance must be only some diffusion lengths. For the purpose of measuring photoelectric conductivity it is necessary to coat the plate ends with a metallic layer, or to fix the electrodes far enough from the illuminated

Card 3/4

67308

Elimination of the Edge Effect in the Measurement of the Photomagnetic Electromotive Force in Semiconductors SOV/181- 1 -8-13/32

part. The author thanks S. G. Kalashnikov and G. Ye. Pikus for the subject suggested and for valuable advice. There are 8 references, 4 of which are Soviet.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors of the AS USSR, Leningrad)

SUBMITTED: August 5, 1958

Card 4/4

24.7700

~~24 (3), 9 (3)~~

67309

SOV/181-1 -8-14/32

AUTHORS: Moyzhes, B. Ya., Ravich, Yu. I.

TITLE: On a Possibility of Detecting Excitons in Germanium and Silicon

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 8, pp 1243 - 1245 (USSR)

ABSTRACT: According to the authors' opinion excitons in germanium (besides the optical effects) should become conspicuous in the kinetics of photoconductivity at low temperatures (around 1.5°K). In any domain of germanium many pairs are supposed to be produced by light. An electron and a hole may combine to form an exciton and emit a phonon. Under certain conditions this process is more probable than ordinary recombination. At 1.5°K the forming excitons are stable concerning dissociation. If exciton lifetime with respect to annihilation is of the same order as the usual lifetime of minority carriers in germanium, then an observation of exciton diffusion and light-induced dissociation might be expected. With exciton concentration of the order 10^{15}, the electrons and holes combined to excitons may contribute to the electric conductivity in analogy to the

Card 1/3

67309

On a Possibility of Detecting Excitons in Germanium and Silicon SOV/181- 1 -8-14/32

"impurity band". Electron-hole combination probability yielding a ground-state exciton was estimated for the simple Mott model with isotropic actual masses, i.e., similar to the manner in which A. I. Ansel'm and Yu. A. Firsov ascertained the exciton free path in an atomic crystal. Binding energy is mainly transformed into kinetic energy of the exciton, and the forming phonon compensates for the exciton quasi-momentum. An expression is written down for the number Q of binding events per cm^3 and per sec. When introducing the numerical values into Q, the anisotropy of the effective electron masses and the valency band edge degeneration in germanium and silicon must be considered. By means of the effective mass values obtained from cyclotron resonance, the ground-state energy of an exciton resulting from an electron and a heavy hole can be estimated: 0.005 ev for germanium and 0.017 ev for silicon. Subsequently, a formula is derived for the estimation of the possible electron (n) and exciton (N) concentration. When 0.2 w of radiant energy in the range of the continuous absorption spectrum fall

Card 2/3 upon 1 cm^2 of an aluminum plate 100 μ thick ($I \sim 10^{20}$ pairs/cm^3.sec),

67309

On a Possibility of Detecting Excitons in Germanium and Silicon SOV/181- . . 14/32

then with a capture time of $\tau = 10\ \mu$ sec of the electron (hole) from the exciton the respective concentrations are found to be $n \sim 10^{13}\ 1/cm^3$ and $N \sim 10^{15}\ 1/cm^3$. Though rough, these estimations show that in the experiment suggested by the authors observable exciton concentrations can be attained. The authors thank A. I. Ansel'm and G. Ye. Pikus for their critical remarks. There are 9 references, 6 of which are Soviet.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors of the AS USSR, Leningrad)

SUBMITTED: August 5, 1958

Card 3/3

24.7700
9.4310
~~9(3), 24(6)~~

67323

SOV/181-1-8-28/32

AUTHOR: Moyzhes, B. Ya.

TITLE: Cutoff Frequency of a Drift Transistor in Consideration of Variations in the Entraining Field and Carrier Mobility in the Base

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 8, pp 1308-1311 (USSR)

ABSTRACT: In drift transistors an electric or "quasielectric" field by respective distribution of the admixtures or by fusion of semiconductors having different band width is used to accelerate the motion of minority carriers from the emitter junction to the collector junction in the base. The entraining field $\vec{E}$ and the mobility μ in particular can vary in the base within wide limits. Reference is made to several previous papers. In an ordinary transistor the cutoff frequency approximately agrees with the reciprocal carrier diffusion time. First, the author carried out a qualitative investigation of facts restricting the cutoff frequency of the drift transistor. Two short minority carrier pulses are supposed to have been sent from the emitter to the base: one positive (injection) and one negative (extraction), both in regard to a certain constant

Card 1/4

67323

SOV/131- 1-8-28/32

Cutoff Frequency of a Drift Transistor in Consideration of Variations in the Entraining Field and Carrier Mobility in the Base

level. The field carries these pulses toward the collector, and diffusion "scatters" them. The same happens when a sinusoidal current is applied to the emitter: Maxima and minima of the sine curve are scattered and the signal amplitudes become smaller. The change in potential energy of the carriers has to be great as compared to kT, should the cutoff frequency be considerably increased as compared to an ordinary transistor. Therefore, the pulse width will always be much smaller than the base width. Under this assumption the author deals with the present problem. At the point $x = 0$ a very short pulse with $N(t_o)$ carriers is supposed to be injected at the instant $t = t_o$. A solution may be approximated by means of the following heuristic principle: The pulse shape is supposed to resemble always the Gaussian curve. Then, the center of the pulse must be situated at the point

Card 2/4

4

67323

SOV/181-1-8-28-32

Cutoff Frequency of a Drift Transistor in Consideration of Variations in the Entraining Field and Carrier Mobility in the Base

$\xi = \int_{t_0}^{t} \mu \, E dt'$. The pulse width is determined by the position of the pulse center and may change as a consequence of diffusion and velocity change. The corresponding equations and their solution are written down. This solution approximately satisfies the differential equation

$$\frac{\partial n}{\partial t} = -\mu E \frac{\partial n}{\partial x} - n \frac{\partial (E\mu)}{\partial x} + D \frac{\partial^2 n}{\partial x^2} - \frac{n}{\tau} + \frac{\partial D}{\partial x} \frac{\partial n}{\partial x} .$$

The various summands on the right side of this equation are of different order of magnitude. The dependence of the variable component of the collector current $i_k(t)$ on the variable component of the emitter voltage $V_e(t)$ is then ascertained. The respective curves and formulas are given for several special cases. A graph depicts the dependence of electron

Card 3/4

67323

SOV/181-1-8-28/32

Cutoff Frequency of a Drift Transistor in Consideration of Variations in the Entraining Field and Carrier Mobility in the Base

mobility in silicon (found by V. P. Zhuze). From this curve the dependence of the cutoff frequency ω_{lim} on the impurity concentration at the emitter was determined. When electron concentration increases above $10^{17}/cm^3$, ω_{lim} does not increase. There are 3 figures and 8 references, 2 of which are Soviet.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors of the AS USSR, Leningrad) 4

SUBMITTED: April 28, 1959

Card 4/4

66292

~~24(5), 24(2)~~ 24.7300 SOV/181-1-11-27/27

AUTHOR: Moyzhes, B. Ya.

TITLE: On the Non-central Forces in the Theory of Crystal-lattice Vibration

PERIODICAL: Fizika tverdogo tela, 1959, Vol 1, Nr 11, pp 1770-1774 (USSR)

ABSTRACT: For the sake of simplicity, the author investigates a cubic crystal (Fig) in which the atoms are connected with their neighbors by "valence bonds". First, an expression describing the force exerted on a central atom by neighboring atoms is given and discussed. The introduction of non-central forces into the theory of crystal-lattice vibrations has the effect that the moduli of elasticity, calculated according to the homogeneous static deformation, differ from the "dynamic" constants obtained from the spectra of lattice vibrations on passing to the limit of long waves. For this reason the author suggests a method of introducing non-central forces, which does not lead to these contradictions. To begin with, the author formulates the angles of rotation of the valence bonds of the atoms, and thereafter gives a fairly extensive set of equations (4) which is valid for every single lattice point. Instead of this (infinite) set of equations the author obtains

Card 1/2

66292

SOV/181-1-11-27/27

On the Non-central Forces in the Theory of Crystal-lattice Vibration

a set consisting of 6 equations for 6 unknowns (5) and (6). In this case a passage to the limit of long waves and the comparison of (6) with the equation of propagation of elastic waves in cubic crystals yields results agreeing with those obtained in the case of static deformation. Finally, explicit data concerning the directions [1,0,0], [1,1,1], and [1,1,0] are given. There are 1 figure and 4 references, 1 of which is Soviet.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute for Semiconductors, AS USSR, Leningrad)

SUBMITTED: July 6, 1959

Card 2/2

MOYZHES, B. Ya., IOFFE, A. F. and STIL'BANS, L. S.

"Thermoelectric Effects and Thermal Conductivity of Semiconductors.

report presented at the Intl. Conf. on Semiconductor Physics, Prague,
29 Aug - 2 Sep 1960.

Inst. Tech. Phys., Acad. Sci. USSR Leningrad

S/181/60/002/02/06/033
B006/B067

AUTHOR: Moyzhes, B.Ya.

TITLE: The Theory of Photocells 21 With p-n Junctions 21

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 2, pp. 221-226

TEXT: Today, photocells are usually produced by the diffusion of n-type impurities from the surface into p-type material. Due to the occurrence of an impurity concentration gradient, a field is generated so that one may speak of a drift of the minority carriers. A number of problems arise, especially when the voltage drop in the surface layer becomes $\geq kT/q$ since the part of the element concerned stops working. G. L. Bir and G. Ye. Pikus studied the problem of diffusion of minority carriers produced by light, taking account of the volume and surface recombinations. The present paper deals with two problems: 1) the influence exercised by the distributed resistance in the layer in which the current removal takes place on the characteristics of the photocell; 2) the motion of the minority carrier in the diffusion layer, taking account of the pulling field and the variable mobility. It is assumed that the

Card 1/3 C

element has the shape of a strip with metallic bars on the edges; if the voltage drop in the bars is low and irradiation regular, the problem can be regarded as one-dimensional. The circuit equivalent to such an element is shown in Fig. 1. First, the current-voltage characteristic is investigated without exposure, and formulas (6a) and (7) are obtained; then, the photocell is dealt with for the case of exposure. The current-voltage function in this case is called the load characteristic of the photocell. Fig. 2 shows the shape of such a characteristic. In the second chapter of the paper, the author investigates the influence exercised by the concentration gradient in the surface layer on the quantum yield of the cell. The accelerating effect of the field occurring due to the gradient on the motion of the minority carriers from the surface to the p-n junction and the resulting reduction of losses to the volume recombination are taken into account. This field, in turn, inhibits diffusion of minority carriers to the surface and reduces the losses to surface recombination. An equation for the quantum yield (25) is obtained, which under certain restrictions (carrier lifetime τ, diffusion and electric field are regarded as constant in the layer near the surface, $w \ll \sqrt{D\tau}$) is valid. There are 2 figures and 3 references: VC

The Theory of Photocells With p-n Junctions S/181/60/002/02/06/033
B006/B067

2 Soviet and 1 American.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors of the AS USSR, Leningrad)

SUBMITTED: April 28, 1959

✓C

Card 3/3

MOYZHES, B.Ya.

Effect of temperature on parameters of materials and its relation to the efficiency of thermoelectric generators and refrigerators. Fiz. tver. tela 2 no.4:728-737 Ap '60. (MIRA 13:10)

1. Institut poluprovodnikov AN SSSR, Leningrad.
(Refrigeration and refrigerating machinery)
(Thermoelectricity)

DEVYATKOVA, Ye.D.; PETROV, A.V.; SMIRNOV, I.A.; MOYZHES, B.Ya.

Melted quartz as a model material for measuring thermoconductivity. Fiz. tver. tela 2 no.4:738-746 Ap '60. (MIRA 13:10)

1. Institut poluprovodnikov AN SSSR, Leningrad.
(Quartz) (Heat--Conduction)

MOYZHES, B. YA.

81968
S/181/60/002/04/33/034
B002/B063

24.2120

AUTHORS: Moyzhes, B. Ya., Pikus, G. Ye.

TITLE: The Theory of a Plasma Thermocouple

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 4, pp. 756-774

TEXT: Following a suggestion of Academician A. F. Ioffe the authors of the present paper carried out a theoretical investigation of the physical phenomena observed in plasma thermocouples. Plasma thermocouples convert electric energy into thermal energy in a cesium gas in which the mean free path of the electrons and ions is considerably shorter than the spacing of the cathode and the anode. The current-voltage characteristic and the efficiency for boundary conditions were calculated: 1) Isothermal plasma; 2) no energy exchange between electrons and atoms. An example with the following initial data was calculated: temperature of the cathode: 2,300°K; temperature of the anode: 690°K; spacing: 2mm; cesium pressure: 1 torr; anodic work function: 1.2 ev (Figs. 3 and 4). Hence, the efficiency amounted to 27 per cent. Mention is made of A. I. Ansel'm. There are 6 figures and 19 references: 4 Soviet, 10 American, 4 British, and 1 German.

Card 1/2

81968

The Theory of a Plasma Thermocouple S/181/60/002/04/33/034
B002/B063

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad
(Institute of Semiconductors of the AS USSR, Leningrad)

SUBMITTED: December 9, 1959

Card 2/2

83026

S/181/60/002/008/045/045
B006/B063

24.7600

AUTHORS: Smirnov, I. A., Moyzhes, B. Ya., Nensberg, Ye. D.

TITLE: The Effective Mass of Carriers in Lead Selenide

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 8, pp. 1992-2005

TEXT: The authors studied the thermo-emf α, and the carrier mobility of samples of p-type and n-type PbSe, and give a very detailed report on the results obtained. The carrier concentrations varied from $3.3 \cdot 10^{17}$ to $9.6 \cdot 10^{19} cm^{-3}$. The electron gas is degenerated already here within various temperature ranges. The thermo-emf and the heat conductivity of all samples had already been measured (Ref. 13). A closer examination of the experimental material showed, however, anomalies in the behavior of α within the range of impurity conductivity (100 - $400^{\circ}K$). If the electron gas is not degenerate, the following relation holds for this range. $\alpha = \pm \frac{k}{e}\left[(2+r) + \ln\frac{2(2\pi m^{*}kT)^{3/2}}{h^{3}n}\right]$ (k - Boltzmann

Card 1/4

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The Effective Mass of Carriers in Lead Selenide

constant, e - electron charge, n - electron (hole) concentration, m^* - effective mass of the electrons (holes), h - Planck's constant; r is the exponent in the expression for the energy dependence of the mean free path of the electron, $l(T, \varepsilon) = l_0(T)\varepsilon^r$. If n, m_* and r are temperature-independent, $\alpha = C \ln T + \text{const}$ is obtained (theoretical straight line in Figs. 1 and 2). However, the curves $\alpha = f(\ln T)$ can be represented only partly by straight lines. Both p-type and n-type samples showed deviations for both a high α and α below 180 - 200 µv/deg. The validity of the above formulas is warranted within the "limits of degeneration". In effect, the curves have such a slope also in the straight parts that $\alpha = \mp \frac{k}{e}\left[r - \ln n + \frac{3}{2} \ln \frac{m^*}{m_0} + \frac{3}{2} \ln T + B\right]$ where $B = 2 + \ln \frac{2(2\pi m_0 k)^{3/2}}{h^3}$, and m_0 is the mass of the free electron. These facts may be explained by assuming that the effective mass varies with temperature. The m^*-values of all samples having different carrier concentrations fit the $m^*(T)$ curves well: $m_p^* \sim T^{0.45}$, $m_n^* \sim T^{0.35}$ (Figs. 4

Card 2/4

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B006/B063

The Effective Mass of Carriers in Lead Selenide

and 5). The temperature dependence of electrical conductivity, σ, and of the Hall constant, R, (Figs. 7 and 3) is also indicative of the temperature dependence of m^*. The mobility u, was calculated from σ and R. $\lg u = f(\lg T)$ is shown for p-type (Figs. 8 and 9) and n-type samples (Fig. 10). u may be represented by $u \sim T^{-s}$ for almost the entire temperature range, where s = 2.64 for p-type samples and s = 2.4 for n-type samples. This deviation from the theoretical law - $u \sim T^{3/2}$ for non-degenerate and $u \sim T^{-1}$ for degenerate gas in scattering from acoustic vibrations - may be ascribed to the change of the effective mass with temperature. Considering the change in m^*, $\alpha(T)$ and $u(T)$ are in good agreement with data on the electron component of heat conductivity (cf. Ref. 13). It follows from this that the mean free paths of electrons and holes do not depend on energy (r = 0), unlike what is the case with scattering from acoustic vibrations. In the last section of the present article, some suggestions are made concerning the energy bands in PbSe, PbS, and PbTe, which make it possible to relate the changes in the effective masses of electrons and holes with the changes in the forbidden band widths (Tables 3 - 6). N. V. Kolomoyets, T. S. Stavitskaya, L. S.

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Card 3/4

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The Effective Mass of Carriers in Lead Selenide

Stil'bans, I. V. Mochan, and T. V. Smirnova are mentioned. There are 11 figures, 6 tables, and 29 references: 8 Soviet, 8 US, 8 British, 4 Japanese, and 1 German.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors of the AS USSR, Leningrad)

SUBMITTED: February 4, 1960

Card 4/4

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S/181/60/002/011/025/042
B006/B056

26.16

AUTHORS: Ioffe, A. F., Moyzhes, B. Ya., and Stil'bans, L. S.

TITLE: Thermocouples as Power Sources

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 11, pp. 2834-2857

TEXT: The present very voluminous paper deals with a principally theoretical investigation of the possibilities of using thermoelectric phenomena for generating energy. In principle, there are four possibilities to do so, which base upon the use of four devices: 1) Thermoelectric generators; 2) Cooling plants (refrigeration pumps; 3) Heating plants (heat pumps); and 4) Thermostats and air-conditioning apparatus. All these devices are characterized economically by Z, which has the dimension degree^{-1}, and is a function of the material parameters of the components of the thermocouple: $Z = (\alpha_1+\alpha_2)^2/(\sqrt{\varkappa_1\varrho_1} + \sqrt{\varkappa_2\varrho_2})^2$, where α is the thermo-emf, ϱ the resistivity, and $\varkappa$ the thermal conductivity of the two components. Further, these devices are characterized by the efficiency

Card 1/4

86438

Thermocouples as Power Sources

S/181/60/002/011/025/042
B006/B056

$\eta = \frac{T_2-T_1}{T_2} \frac{\sqrt{1+\vartheta}-1}{\sqrt{1+\vartheta}+T_1/T_2}$ (generators) and the cooling coefficient ε of thermoelectric cooling plants: $\varepsilon = \frac{T_1}{T_2-T_1} \frac{\sqrt{1+\vartheta}-T_2/T_1}{\sqrt{1+\vartheta}+1}$. $\vartheta = ZT_m$, $T_m = (T_1+T_2)/2$. The materials available today have a ϑ of $\simeq 1$ within the temperature range between room temperature and 1200°K. Thus, it is possible, in principle, to produce thermoelectric generators with an efficiency of about 15%, as well as cooling devices with a maximum cooling of 80° (i.e., at a temperature difference of 40°, $\varepsilon \simeq 50\%$). Further, the material properties determining Z are discussed, and the necessity of looking for materials having minimum thermal conductivity of the lattice with maximal mobility, and of increasing $u/\varkappa_{\text{lattice}}$ is stressed. Of such materials, the optimum carrier concentration is given as $n_o = \frac{2(2\pi mkT)^{3/2} \cdot e^r}{h^3}$. Further, problems relating to the usefulness and efficiency of materials with

Card 2/4

86438

Thermocouples as Power Sources S/181/60/002/011/025/042
B006/B056

complicated band structures, and later problems of carrier concentration are discussed. In the following sections, the authors discuss the carrier mobility and their affection by scattering from defects and thermal lattice vibrations; in detail, the scattering by thermal vibrations, impurity ions, and impurities introduced by substitution into chemical compounds (above all, tellurides and selenides), are discussed. In the following sections, the authors discuss problems of heat conduction, the dependence of Z on the degree of carrier degeneracy and on temperature, and describe the operation of thermocouples under nonsteady conditions. Further, possibilities are discussed of increasing the efficiency of thermocouples (thermal conductivity, mobility, and thermo-emf). Liquid and gaseous semiconductors are discussed, and the optimum determination of the geometrical dimensions and the correspondence of the individual parts of the branches of thermocouples. In the last part of the paper, thermocouples with thermionic emission are discussed (vacuum thermocouple without and with compensation of the electronic space charge; plasma thermocouple; and combination of solid and vacuum thermocouples). The paper gives a survey of the present stage of the theory of thermocouples, and discusses possibilities of improving it. The material discussed has been taken mainly

Card 3/4

86438

Thermocouples as Power Sources S/181/60/002/011/025/042
B006/B056

from published papers. I. A. Smirnov, A. I. Ansel'm, A. R. Regel', and A. A. Averkiyev are mentioned. There are 3 figures and 31 references: 19 Soviet, 5 German, 5 US, 1 Canadian, and 1 British.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors of the AS USSR, Leningrad)

SUBMITTED: July 11, 1960

Card 4/4

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S/181/61/003/006/026/031
B102/B214

AUTHORS: Averkin, A. A., Moyzhes, B. Ya., and Smirnov, I. A.

TITLE: Change of electrical properties of PbSe under pressure

PERIODICAL: Fizika tverdogo tela, v. 3, no. 6, 1961, 1859 - 1862

TEXT: The authors investigated the effect of all-sided pressures of up to 9000 kg/cm^2 on thermo-emf α and electric conductivity σ of p- and n-type PbSe samples at room temperature. Oil was used for transmitting the pressure, which was measured by a magnetic manometer. Temperature was measured by copper-constantan thermoelements. The temperature difference between the two ends of the samples was $\sim 10^{\circ}$C. The mean temperature deviation in the whole range of pressures was not more than 0.2°C. An a. c. probe was used to measure σ. The degeneracy was taken into account in calculating α, σ, the carrier concentration n, the effective mass m*, and the carrier mobility u under the assumption that the mean free path l does not depend on the carrier concentration. The values obtained are collected in the table. m* was calculated from the change of thermo-emf, i. e. by using the formulas

Card 1/5

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R001135510001-4"

Change of electrical... 24??? S/181/61/003/006/026/031
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$$\alpha = \frac{k}{q}\left[\frac{r+2}{r+1}\frac{F_{r+1}(\mu^*)}{F_r(\mu^*)} - \mu^*\right]; \quad \frac{1}{\alpha}\frac{d\alpha}{dP} = \frac{k}{\alpha q}\left[\frac{r+2}{r+1}\frac{d}{d\mu^*}\left(\frac{F_{r+1}}{F_r}\right) - 1\right]\frac{d\mu^*}{dP}, \quad (1)$$

$$n = \frac{4\pi(2m^*kT)^{3/2}}{h^3}F_{1/2}(\mu^*); \quad \frac{d\ln m^*}{dP} = -\frac{1}{3}\frac{F_{-1/2}(\mu^*)}{F_{1/2}(\mu^*)}\frac{d\mu^*}{dP}, \quad (2)$$

when l depends on the energy in the form $l(\varepsilon) \sim \varepsilon^r$. Here F_r are the Fermi integrals and μ^* the level of the chemical potential in kT units. It was assumed that r = 0. To obtain separately change in mobility connected with a change in μ^*, the equivalent change in mobility for a nondegenerate sample was calculated from

$$\sigma = nqu_{\text{nes.}}\frac{\Gamma\left(\frac{3}{2}\right)}{\Gamma(r+1)}\frac{F_r(\mu^*)}{F_{1/2}(\mu^*)}; \quad \frac{d\ln\sigma}{dP} = \frac{d\ln u_{\text{nes.}}}{dP} + \frac{d}{d\mu^*}\left(\frac{F_r}{F_{1/2}}\right)\frac{d\mu^*}{dP}, \quad (3)$$

The following conclusions were drawn from the results of measurement: 1) From the fact that the p- and n-type samples showed very similar changes of the effective masses (1.64 and 1.86 % per ton) it can be assumed that the bottom of the conduction band and the upper edge of the valence band are situated at one point of k-space, and the components of
Card 2/5

the effective mass tensor are mainly determined by the matrix elements of momentum; in the principal axes $\frac{m_0}{m^*_{ie,h}} \approx 2\frac{|\langle\psi^*_e|\nabla_i|\psi_h\rangle|}{E_g m_0}$ holds. The subscripts e and h on the wave functions refer respectively to electron and hole. E_g is the forbidden band width and m_0 the [illegible] mass. 2) The magnitude of the relative change of the effective mass on compression compared to the change of the atomic distance is [illegible] explained with the help of this zone scheme. The compressibility of PbSe is $2.07\cdot 10^{-6}$ cm^2/kg. At 1000 kg/mm^2 the atomic distance changes by 0.07 % while the effective mass changes by 1.8 %. 3) It is known from the theory of deformation potential that the effective mass changes on deformation to a greater extent than the constant of the deformation potential. This was confirmed here also as in Ref. [illegible] (Smirnov et al. FTT, II, 8, 1992, 1960). 4) It was found in Ref. [illegible] that $m^* \sim T^{0.4}$. It is now sought to find out which part of the change of m^* is directly determined by the thermal expansion and which by the lattice vibrations. It is found that for both these effects together $\delta m^*/m^* = 1.8$ % per ton, while

24929

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B102/B214

Change of electrical...

here $\delta m^*/m^* = 1.8$ % per ton pressure. This means that about 60 % of the change of m^* is related directly to the atomic vibrations and about 40 % can be attributed to the thermal expansion. The quantity ... charac- terizing the efficiency of a substance in thermoelectric apparatus in- creases significantly with pressure. The authors thank Ye. D. Devyatkova, G. Ye. Pikus, and A. R. Regel' for discussions, and G. D. Nensberg for preparing the single crystals. There are 1 figure, 1 table, and 7 refer- ences: 5 Soviet-bloc and 2 non-Soviet-bloc.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors, AS USSR, Leningrad)

SUBMITTED: January 24, 1961

Card 4/5

MOYZHES, B.Ya.; PARFEN'YEV, R.V.; CHUDNOVSKIY, F.A.; EFROS, A.L.

Approximate calculation of the mean group velocities of phonons in cubic crystals. Fiz.tver.tela 3 no.7:1933-1940 Jl '61. (MIRA 14:8)

1. Institut poluprovodnikov AN SSSR, Leningrad.
(Lattice theory)

29695
S/181/61/003/010/022/036
B104/B108

24,7700 (1164,1385,1559)

AUTHORS: Golikova, O. A., Moyzhes, B. Ya., and Stil'bans, L. S.

TITLE: Hole mobility in germanium as a function of concentration and temperature

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 3105 - 3114

TEXT: The hole mobility in p-type germanium with an acceptor concentration of $4.9\cdot10^{13}$ - $4\cdot10^{20}$ cm^{-3} was investigated in the temperature range of from 77 to $450^{o}K$. The carrier concentration was determined by measuring the Hall effect in magnetic fields of 50 - 38,000 oe in the above range of temperatures. Specimens were produced by zone melting during which the germanium was alloyed with gallium. Mobilities of different specimens as functions of temperature are given in Figs. 1 and 2. The carrier concentrations of the different specimens ranged from $4.9\cdot10^{13}$ to $6.4\cdot10^{16}$ cm^{-3} at $77^{o}K$ (Fig. 1), and from $1.2\cdot10^{17}$ to $4.2\cdot10^{20}$ cm^{-3} at $300^{o}K$ (Fig. 2). The measurement results were checked with specimens

Card 1/5

29695
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Hole mobility in germanium...

having concentrations of 10^{15} - 10^{16} cm^{-3}, produced at the Institut metallurgii AN SSSR (Institute of Metallurgy, AS USSR) by Chokhral'skiy's method. Results are given in Fig. 3. In a detailed discussion of the results the authors show that in the range of carrier concentrations from 10^{15} to $3\cdot10^{19}$ cm^{-3} the experimental data on the carrier mobility in p-type germanium in the temperature range from 77 to 450°K can be explained qualitatively and quantitatively by theories of carrier scattering from ionized impurities. The mobility is one-hundredth of that of pure materials. The ratio u_{theor}/u_{exp} (u = mobility) is equal to unity up to concentrations of 10^{17} cm^{-3}, has a maximum of nearly 2 at 10^{18} cm^{-3}, decreases to 1.6 and, at a concentration of $5\cdot10^{19}$ cm^{-3} starts rising again. The authors thank M. I. Vinogradov for help, and V. S. Zemskov (Institute of Metallurgy, AS USSR) for supplying the control specimens. There are 6 figures and 17 references: 3 Soviet and 14 non-Soviet. The four most recent references to English-language publications read as follows: E. G. S. Page. Phys. Chem. Sol., 16, 207, 1960; T. P. McLean, E. G. S. Page. Phys. Chem. Sol., 16, 220, 1960; F. A. Trumbore, A. A. Tartaglia. J. Appl. Phys., 29, 1511, 1958; A. C. Beer,

Card 2/~~5~~ 3

29695
S/181/61/003/010/022/036
B104/B108

Hole mobility in germanium...

R. K. Willardson. Phys. Rev., 110, 1286, 1958.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors AS USSR, Leningrad)

SUBMITTED: May 27, 1961

Fig. 1. Hall mobility as a function of temperature. Legend: The figures by the curves indicate the number of specimen. On top-specimens with lower carrier concentration.

Fig. 2. Hall mobility as a function of temperature. Legend: see Fig. 1.

Fig. 3. Hall mobility as a function of carrier concentration at room temperature. Legend: (1) specimen examined in the present paper; (2) specimens supplied by the Institute of Metallurgy, AS USSR; (3) data taken from the paper of F. A. Trumbore et al.; (4) data taken from the paper of W. C. Dunlap, Phys. Rev., 79, 286, 1950.

Card 3/3

44171

S/181/62/004/012/019/052
B104/B102

AUTHORS: Golikova, O. A., Moyzhes, B. Ya., and Orlov, A. G.

TITLE: The mobility of holes in germanium as a function of their concentration and temperature

PERIODICAL: Fizika tverdogo tela, v. 4, no. 12, 1962, 3482-3491

TEXT: A previous work (O. A. Galikova et al., FTT, 3, 10, 1961) in which the carrier mobility of gallium-doped p-type germanium was determined between 77 and 450°K is here continued. Ge specimens having gallium concentrations of up to $7\cdot10^{20}$ cm^{-3} were used for determining the electrical conductivity and the Hall effect between 450 and 1000°K, at which temperatures a noticeable electron concentration already arises. In calculating the carrier mobility, the collisions between carriers for a nondegenerate electron gas and the scattering from both acoustic and optical vibrations were taken into account. This permitted of comparing theory with experiment at higher temperatures also. The measurements were made in an argon atmosphere using platinum probes and Pt-PtRh thermocouples. It was possible to determine the temperature dependence of the Hall effect at

Card 1/2 (1) S/181/61/003/010/022/036

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B104/B102

The mobility of holes in germanium ...

magnetic field strengths up to 10 koe. Results: At temperatures below 300°K, the experimental and theoretical results agree fairly well if the scattering from optical and acoustic vibrations, from ionized and neutral impurities and the scattering of holes from holes is taken into account. At higher temperatures the theory differs considerably from experiment, which is explained by the fact that the mobility in scattering from lattice vibrations decreases more rapidly than is predicted by theory: $u_{lattice} \sim T^{-3}$ instead of $T^{-2.3}$. This strong decrease cannot be explained by the fact that the carrier energy approaches the spin-orbital splitting in germanium ($\Delta = 0.29$ ev). Spectral analyses showed that with $n < 5 \cdot 10^{19}$ cm^{-3} at nitrogen temperature the Hall concentration equals that of the gallium atoms; in the case of stronger alloying, the concentration determined from Hall coefficient is too high. There are 9 figures and 2 tables.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors AS USSR, Leningrad)

SUBMITTED: July 6, 1962

Card 2/2

37066
S/057/62/032/004/012/017
B139/B102

26 2532

AUTHORS: Moyzhes, B. Ya., Petrov, A. V., Shishkin, Yu. P., and ~~Kolomoyets, L. A.~~

TITLE: Choice of the optimum design of a cascade thermocouple

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 4, 1962, 461-472

TEXT: A method was developed for calculating the efficiency of a thermocouple consisting of several sections made of different alloys to ensure the best thermoelectrical properties for each temperature range in question. If the optimum current is expressed by

$I_{opt} = \frac{\varkappa S}{\alpha T}\frac{dT}{dx}(M - 1) = \frac{Q_\varkappa(M - 1)}{\alpha T}$ (4), one finds $d\eta_{max} = \frac{dT}{T}\frac{M - 1}{M + 1}$ (5)

for one section. dT is the temperature gradient, ρ is the resistivity of the section, dx is its length, S is the wire cross section,

$M = \sqrt{1 + zT}$, $Q_\varkappa$ is the heat flux, $z = \frac{\alpha^2\sigma}{\varkappa}$, α is the thermo-emf,

Card 1/3

Choice of the optimum design of ... S/057/62/032/004/012/017
B139/B102

σ is the electrical conductivity, and $\varkappa$ is the thermal conductivity. The differential equations are solved, and the part of Joulean, Thomson, and Peltier heat returning to the hot junction is calculated. Each section is assumed to have equal thermal conductivity. As the efficiency cannot be separately determined for each section, the ratio between $d\eta$ and the maximum efficiency, $d\eta_{max}$, of the material used for the section in question is calculated, and an approximate condition is derived from (4) at $zT \lesssim 1$: $\frac{j}{\varkappa}$ = const. Then, j_{opt} is determined, and the actual efficiency of the entire thermocouple is calculated. The complete calculation of a thermocouple is presented for purposes of illustration. Bi_2Te_3 alloys are used for low temperatures, and PbSe alloys for high temperatures. The thermocouple consists of 4 sections in the negative branch, and of 3 sections in the positive one. The temperature range is 20-700°C, and η = 12.7%. For the negative branch, the $d\eta/d\eta_{max}$ = f(T) curves are better than for the positive branch, where $d\eta/d\eta_{max}$ near 700°C becomes negative and thus reduces the total emf.

Card 2/3

Choice of the optimum design of ...

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There are 11 figures. The English-language reference reads as follows: R. Sherman, R. Hükess, R. Ur . JAP, 31, 1, 1960.

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors AS USSR Leningrad)

SUBMITTED: May 6, 1961

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Card 3/3

On thermal conductivity of the system of solid solutions PbTe-PbS. Ye. D. Devyatkova, V. V. Tikhonov, N. A. Smirnov.

Change of the electrical properties of PbSe, PbTe, and PbS under close pressure. A. D. Averkin, A. A. Andreyev, I. G. Dombrovskaya, B. Ya. Moyznes, E. D. Nensberg.

Report presented at the 3rd National Conference on Semiconductor Compounds, Kishinev, 16-21 Sept 1963

44

S/181/63/005/001/015/064
B102/B186

AUTHORS: Averkin, A. A., Dombrovskaya, I. G., and Moyzhes, B. Ya.

TITLE: The change in the forbidden band width under pressure

PERIODICAL: Fizika tverdogo tela, v. 5, no. 1, 1963, 96-99

TEXT: The change in the electric conductivity σ and the Hall constant under omnilateral pressure up to 15,000 kg/cm^2 was measured on p-type PbSe single crystals in a temperature range between 297 and 420°K. The change in the forbidden band width E_g dependent on the pressure was calculated. The carrier concentrations of the specimens studied were between $\sim 10^{17}$ and $\sim 10^{18}$ cm^{-3}. E_g is calculated from the relation

$$E_g = kT \ln \frac{4X^3(m_1^* m_2^*)^{3/2}}{n_o^2\gamma(1+\gamma)}$$

where $X = 2\pi kT/h^2$, m_1^* and m_2^* are the effective masses of holes and electrons and $\gamma = n_2/n_o$, n_o is the concentration of

Card 1/2

the impurity carriers and n_0 that of the minority carriers (electrons). $dE_g/dP = -(7.5 \pm 0.5) \cdot 10^{-6}$ ev/kg·cm^{-2} was obtained. At room temperature, E_g = 0.26 - 0.29 ev. At a pressure of $\sim$38,000 kg/cm^2 the forbidden band has completely disappeared. This pressure is close to that calculated by Bridgman (45,000 kg/cm^2) for the PbSe phase transition. E_g increases with temperature: $dE_g/dT = +6 \cdot 10^{-4}$ ev/deg. The relative mobility u_1/u_{10} of the majority carriers increases linearly with pressure; u_{10} is the majority carrier mobility at room temperature. The results confirm the relationship between effective carrier mass and forbidden band width which the authors assumed earlier (FTT, 3, 6, 1850, 1961). There are 5 figures.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors AS USSR, Leningrad)

SUBMITTED: July 20, 1962

Card 2/2

L 18001-63 EWP(q)/EWT(m)/BDS AFFTC/ASD JD/JG

ACCESSION NR: AP3001287 S/0181/63/005/006/1657/1667

AUTHORS: Vinogradova, M. N.; Golikova, O. A.; Dubrovskaya, I. N.; Moyzhes, B. Ya.

TITLE: Thermoelectromotive force of p-type germanium in relation to concentration and temperature 63 59

SOURCE: Fizika tverdogo tela, v. 5, no. 6, 1963, 1657-1667

TOPIC TAGS: thermoelectromotive force, Ge, Ga, intrinsic conductivity, Hall effect, current carriers, Chromel, Copel, p-type semiconductor

ABSTRACT: The authors undertook this study because of lack of data on either polycrystalline material or single crystals having high concentrations of current carriers. They investigated single crystals in the concentration interval 7×10^{17} to 7×10^{20} per cm^3 and the temperature interval 300-950K. Specimens were prepared by zone refining, during which the Ge was alloyed with Ga. Concentration of current carriers was determined by measuring the Hall effect. To avoid errors resulting from surface attachment of thermocouples, the thermoelectromotive force was measured by thermocouples of Chromel-Copel welded to platinum pins driven into small holes (0.3 mm) in the specimens. Measurements at high temperatures were made in an argon atmosphere. Variations between computed and

Card 1/2

L 18001-63

ACCESSION NR: AP3001287

4

experimental values were observed for concentrations above 10^{20} per cm^3 at 300K and also for lower concentrations at temperatures above 300K. These have been explained by deviations from the square law of dispersion with increase of energy. This explanation is in agreement with the change of electrical conductivity, the Hall constant, and the thermoelectromotive force in the region of almost intrinsic conductivity. "The authors thank L. S. Stil'bans for his interest in the work, A. V. Ioffe for making the measurements on thermal conductivity, and A. V. Petrov for advice on the technique of measuring the thermoelectromotive force." Orig. art. has: 7 figures, 1 table, and 16 formulas.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors, Academy of Sciences, SSSR)

SUBMITTED: 24Dec62 DATE ACQ: 01Jul63 ENCL: 00

SUB CODE: PH NO REF SOV: 007 OTHER: 015

Card 2/2

SMIRNOV, I.A.; MOYZHES, B.Ya.

Change in the heat conductivity of cubic crystals due to deformation. Fiz. tver. tela 5 no.7:1958-1960 Jl '63. (MIRA 16:9)

1. Institut poluprovodnikov AN SSSR, Leningrad.
(Crystals--Thermal properties) (Deformations (Mechanics))

S/109/63/008/002/010/028
D413/D308

AUTHORS: Iorish, A.Ye., Krasin'kova, M.V., Moyzhes, B.Ya., and Sorokin, O.V.

TITLE: The thermal emf, electric conductance and resistance variation in a magnetic field of barium-strontium oxide

PERIODICAL: Radiotekhnika i elektronika, v. 8, no. 2, 1963, 269-278

TEXT: Although a number of papers have dealt with measurements of thermal emf, $\Delta\rho/\rho$ in a magnetic field, and electrical conductance of cathode oxide coatings, these data have been considered in isolation. Here they are all examined together in the light of the accepted theory that conduction in oxide coatings occurs through the pores, which are filled with electron gas by thermionic emission from their walls. First a theoretical treatment is given for the values of thermal emf, conductance and $\Delta\rho/\rho$ for the electron gas in the pores, and then experimental results for barium-strontium oxide

Card 1/2

are presented and discussed. The linear relation of $\Delta\rho/\rho$ to H in weak magnetic fields is explained: the work function relative to the bottom of the conduction zone is evaluated: the dimensions of the pores for maximum conductance are calculated with allowance for the space-charge in the pores. There are 8 figures.

SUBMITTED: April 26, 1962

DEVYATKOVA, Ye. D.; IOFFE, A. V.; MOYZHES, B. Ya.; SMIRNOV, I. A.; KUTASOVA, B. A.; GURYEVA, E. A.

"Change of thermal conductivity of the crystal lattice at uniaxial elastic stress or at the introduction of impurities and thermal imperfections."

report submitted for Intl Conf on Physics of Semiconductors, Paris, 19-24 Jul 64.

ACCESSION NR: AP4017600 S/0109/64/009/002/0300/0307

AUTHOR: Dubova, T. A.; Iorish, A. Ye.; Krasin'kova, M. V.; Moyzhes, B. Ya.; Petrov, I. N.; Sorokin, O. V.; Chudnovskiy, F. A.

TITLE: Electrical conductivity and thermo-emf of a barium-strontium oxide in a magnetic field

SOURCE: Radiotekhnika i elektronika, v. 9, no. 2, 1964, 300-307

TOPIC TAGS: electrical conductivity, thermo emf, oxide coated cathode, barium strontium oxide, barium strontium oxide thermo emf, barium strontium oxide conductivity

ABSTRACT: Measurements were taken of factory specimens of Ba-Sr oxide, 100-200-microns thick, placed between two cylindrical nickel bases (see Enclosure 1) and subjected to a transverse magnetic field. One of the tubes was equipped with a ring anode and served to measure the thermo-emission from the

ACCESSION NR: AP4017600

side surface of the oxide. The effect of temperature and the magnetic field on the resistivity and thermo-emf of the Ba-Sr oxide was investigated. Estimated from experimental results, the free-path length of an electron in the cathode pores is 4-30 microns and the electron mobility is from 3.5×10^4 to 2×10^5 cm^2/v sec for the various specimens. The thermodynamic work function, electron concentration, and conductivity are also estimated. It is inferred that the pores in the oxide cathode must be open and intercommunicating and, therefore, that under total thermionic-current conditions, the electrons must be emitted by the entire near-surface layer of the oxide; this fact may, in part, explain the abnormally high Schottky effect in oxide cathodes. Orig. art. has: 7 figures, 13 formulas, and 1 table.

ASSOCIATION: none

SUBMITTED: 30Dec62 DATE ACQ: 18Mar64 ENCL: 01

SUB CODE: GE NO REF SOV: 001 OTHER: 003

ACCESSION NR: AP4043679 S/0109/64/009/008/1447/1457

AUTHOR: Iorish, A. Ye.; Moyzhes, B. Ya.; Sorokin, O. V.; Chudnovskiy, F. A.

TITLE: Temperature distribution in a cathode oxide coating

SOURCE: Radiotekhnika i elektronika, v. 9, no. 8, 1964, 1447-1457

TOPIC TAGS: oxide cathode, electron tube, electron tube cathode, $(BaSrCa)CO_3$ cathode, $(BaSr)CO_3$ cathode

ABSTRACT: The theoretical and experimental investigation of the temperature distribution in an oxide-coated cathode is reported. The theoretical part differs from the well-known work of H. C. Hamaker (Philips Res. Repts., 1947, 2, 55-67, 103-111, 112-125) in that the temperature drop in the oxide is not assumed small, and an allowance is made for the Joule heat in the oxide, for the refractive index of the oxide, and for the radiation reflected by the anode. The experimental part includes measuring the thermal conductivity ($10^{-5} - 3 \times 10^{-6}$ w/cm-degree) of oxide-coating grains at temperatures ranging from room temperature

Card 1/2

ACCESSION NR: AP4043679

down to liquid-nitrogen temperature. It is estimated that the temperature of the oxide may be higher than that of the cathode base by hundreds of degrees when heavy emission currents are involved; a still higher difference is possible under pulsed operating conditions of the tube. The anode reflection has an essential effect on the temperature distribution. Hot spots on the cathode due to low thermal conductivity at heavy emission or due to an insufficient rate of heat removal from an underheated cathode may result in sparking; a formula giving a criterion of the cathode thermal instability is offered. The heat radiation capacity of a Ni-base oxide cathode was measured; the radiation dissipation factor, which corresponds to a photon free-path length of 30—50 microns at 800—900C, is estimated. Orig. art. has: 5 figures, 31 formulas, and 2 tables.

ASSOCIATION: none

SUBMITTED: 15Jun63 ENCL: 00

SUB CODE: EC NO REF SOV: 005 OTHER: 011

L 52527-65 EWT(1)/EWT(m)/T/EWP(t)/EWP(b)/EWA(c) IJP(c) ID UR/0181/65/007/004/1065/1077
ACCESSION NR: AP5010712 23 21 B

AUTHOR: Kutasov, V. A.; Moyzhes, B. Ya.; Smirnov, I. A.

TITLE: Thermal and electric properties, and the width of the forbidden band of the system of solid solutions Bi_2Te_3-Sb_2S_3

SOURCE: Fizika tverdogo tela, v. 7, no. 4, 1965, 1065-1077

TOPIC TAGS: bismuth compound, antimony compound, solid solution, electric conductivity, thermal emf, thermal conductivity, forbidden band

ABSTRACT: The authors measured the electric conductivity, the thermal emf, and the thermal conductivity of crystals of solid solution Bi_2Te_3-Sb_2S_3 in the direction of the cleavage planes. The apparatus used for the measurements was described in an earlier paper (FTT v. 2, 738, 1960). From the measurement results in the region of the start of the intrinsic conductivity, the authors calculated the width E_g of the forbidden band of Bi_2Te_3 and of the solid solution Bi_2Te_3-Sb_2S_3 (up to 9% of Sb_2S_3). The width was directly proportional to the added amount of Sb_2S_3, and increased 0.005 eV for each per cent of introduced Sb_2S_3. Its time derivative

Card 1/2

L 52527-65
ACCESSION NR: AP5010712

2

- dE_g/dT in the interval 300--420K is practically the same for the Bi_2Te_3 and the solid solution. The values of E_g calculated from different experimental data are in good agreement. The agreement between E_g obtained from optical measurements and the authors' calculations confirms that the mean free path of the carriers does not depend on the energy. "The authors thank Ye. G. Guriyev for help with the samples." Orig. art. has: 7 figures and 33 formulas.

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors, AN SSSR)

SUBMITTED: 30Sep64 ENCL: 00 SUB CODE: SS, EM

NR REF SOV: 007 OTHER: 013

Card 2/2

L 4875-66 EWT(1) IJP(c)

ACCESSION NR: AP5019841 UR/0181/65/007/008/2309/2317

AUTHORS: Kudinov, V. A.; Moyzhes, B. Ya.

TITLE: Effect of random inhomogeneities of the measurement of the thermal emf and the Nernst coefficient in a strong magnetic field

SOURCE: Fizika tverdogo tela, v. 7, no. 8, 1965, 2309-2317

TOPIC TAGS: crystal imperfection, cubic crystal, single crystal, thermal emf, Nernst effect, electric conductivity, thermal conductivity

ABSTRACT: The analysis in the article is confined to inhomogeneities which have dimensions that are small compared with the sample size, but are large compared with the characteristic dimensions such as the Debye length or the mean free path. The analysis is first developed for carrier concentration inhomogeneities in single cubic crystals. It is shown that the relative influence of the random inhomogeneities increases with increasing field and measurement of the Nernst co-

Card 1/2

15

L 4875-66
ACCESSION NR: AP5019841

efficient, but does not increase with increasing field in measurements of the longitudinal and transverse thermal emf. A formula is derived relating the corrections for the inhomogeneity in measurements of the transverse resistance and the Nernst coefficient in a strong field. Asymptotic expressions for the kinetic coefficients are then used to extend the results to include polycrystalline samples. The influence of inhomogeneities on the measurements of electric conductivity, thermal conductivity, and thermal emf without a magnetic field, for materials having a high thermal electric efficiency, is briefly analyzed and the contributions of the eddy currents connected with the temperature gradients resulting from the inhomogeneities of ther thermal emf are estimated. The authors thank S. V. Ayrapetyants, I. V. Mochan, Yu. I. Ravich, and S. S. Shalyt for useful discussions. Orig. art. has: 1 figure and 51 formulas

ASSOCIATION: Institut poluprovodnikov AN SSSR Leningrad (Institute of Semiconductors, AN SSSR)

SUBMITTED: 13Feb63 ENCL: 00 SUB CODE: SS

NR REF SOV: 004 OTHER: 002

Card 2/2

L 6334-66 EWT(m)/ETC/EWG(m)/EWP(t)/EWP(b) IJP(c) RDW/JD

ACCESSION NR: AP5019876 UR/0181/65/007/008/2524/2527

57
56

AUTHOR: Yefimova, B. A.; Kaydanov, V. I.; Moyzhes, B. Ya.; Chernik, I. A.

TITLE: On the band model of SnTe

SOURCE: Fizika tverdogo tela, v. 7, no. 8, 1965, 2524-2527

TOPIC TAGS: tin compound, telluride, electric conductivity, Hall effect, thermoelectric power, Nernst effect, impurity band

ABSTRACT: By introducing impurities (Sn, Te, Cl) the authors have succeeded in obtaining polycrystalline samples of p-SnTe with concentrations at p^*_{300K} = 2.8×10^{19} --2.0×10^{21} cm^{-3}, and determine the band model of SnTe for this range of concentrations, which was not investigated thoroughly in the past. Measurements were made of the electric conductivity, thermoelectric power, Hall constant, and the isothermal constant of the transverse Nernst-Ettingshausen effect, as well as the variation of the thermoelectric power in a magnetic field. The authors suggest that the results obtained provide some new evidence of the correctness of the semiconductor model of SnTe with two valence bands. The anomalously large Nernst-Ettingshausen effect can then be explained by supplementing this model with an account of the intraband scattering. Orig. art. has: 2 figures, 1 formula, and 1 table.

Card 1/2

0905 0032

L 6334-66

ACCESSION NR: AP5019876

ASSOCIATION: Institut poluprovodnikov AN SSSR, Leningrad (Institute of Semiconductors AN SSSR)

SUBMITTED: 12Mar65 ENCL: 00 SUB CODE: SS

NR REF SOV: 000 OTHER: 006

nw

Card 2/2

L 00862-66 EWT(m)/EWG(m)/T DS

ACCESSION NR: AP5015811

UR/0109/65/010/006/1088/1093
621.385.735

14
B

AUTHOR: Iorish, A. Ye; Moyzhes, B. Ya.; Nilov, O. M.; Chudnovskiy, F. A.

TITLE: Pulse emission and thermal conditions of the oxide-coated cathode

SOURCE: Radiotekhnika i elektronika, v. 10, no. 6, 1965, 1088-1093

TOPIC TAGS: oxide coated cathode

ABSTRACT: Pulse current-voltage characteristics of the triode section of a GF1P oxide-cathode tube were measured; 5-μsec pulses singly and at repetition rates of 50, 100, 300, and 100 cps were applied. It was found that, with single pulses, the characteristics are close to the normal Schottky law; thus, the hypotheses explaining the high pulse emission by curving the zones at the surface, by secondary emission, and by surface inhomogeneity have been disproved. The emission monotonously increased with the repetition rate. This can be explained by the heating up of the oxide surface if the very little thermal conduction of the oxide coating is taken into account. It was also found that the cathode heat exchange through radiation is comparable to that through thermal conduction. Orig. art. has: 3 figures, 6 formulas, and 2 tables.

Card 1/2

L 00862-66

ACCESSION NR: AP5015811

ASSOCIATION: none

SUBMITTED: 29Dec63 ENCL: 00 SUB CODE: EC

NO REF SOV: 006 OTHER: 004

Card 2/2

L 5139-66 EWT(l)/EWT(m)/EWP(i)/ETC/EPF(n)-2/EWG(m)/EPA(w)-2/T/EWP(t)/EWP(b)
ACCESSION NR: AP5026904 IJP(c) JD/AT UR/0109/65/010/010/1845/1855
621.385.735

44,55 44,55

AUTHOR: Moyzhes, B. Ya.; Petrov, I. N.; Sher, E. M. 44,55

55
53

TITLE: Pulse electrical conductivity of a porous oxide cathode coating 18

SOURCE: Radiotekhnika i elektronika, v. 10, no. 10, 1965, 1845-1855

TOPIC TAGS: oxide coated cathode 21,44,55

ABSTRACT: R. Loosjes, H. J. Vink (Philips Res. Repts, 1949, 4, 449), R. Forman (Phys. Rev., 1954, 96, 6, 1479) and other researchers considered the conductivity of an electron gas in the oxide pores in weak fields, when the current in the pores was proportional to the electric field and when the energy gained by the electrons along their free paths was small as compared to their thermal energy kT. This article considers the case of an arbitrary electric field, when the voltage drop along the free path is near or exceeding kT/q, where q is the electron charge. An integral formula for L_a/l_0 is developed and a table facilitating evaluation of the integrals is supplied; here L_a is the electron drift and l_0 is the electron free path. An experimental BaSrCa-oxide cathode was tested by

Card 1/2

L 5139-66

ACCESSION NR: AP5026904

1-μsec pulses at a repetition rate of 50 cps, at 750—1150K, in fields up to 30 kv/cm strong. It was found that the experimental conductivity curves were in good agreement with theoretical curves for the fields up to about 4 kv/cm; the pore current reached values 4 times as high as the emission current. The electron free path and the work function of the oxide determined from the experimental current-voltage characteristics proved to be in good agreement with the values of these quantities determined from other independent measurements (thermo-emf, resistance in magnetic field, etc.) of the same oxide specimens. Orig. art. has: 7 figures, 18 formulas, and 2 tables. [03]

ASSOCIATION: none

SUBMITTED: 16Jul64 ENCL: 00 SUB CODE: EM, EC

NO REF SOV: 003 OTHER: 005 ATD PRESS: 4134

Card 2/2

L 33163-65 EPR/EWT(1)/EWT(m)/EPA(bb)-2/EWP(b)/T/EWP(t) Pz-6/Ps-4 IJP(c)
ACCESSION NR: AP5005227 JD/JG/AT S/0057/65/035/002/0266/0278

AUTHOR: Baksht, F.G.; Moyzhes, B.Ya. 38 35 B

TITLE: Contribution to the theory of the low voltage cesium arc

SOURCE: Zhurnal tekhnicheskoy fiziki, v.35, no.2, 1965, 266-278

TOPIC TAGS: thermoelectronic energy conversion, 21 cesium plasma, cesium vapor diode, excitation, ionization 27

ABSTRACT: The current-voltage characteristic of a hot cathode low voltage cesium arc is calculated for the case when the density is less than 2×10^{12} cm^{-3} and the electron temperature is below about 1700°K. In this case the high energy electrons capable of exciting a cesium atom to the first excited state do not acquire a Maxwellian distribution but are simply accelerated by the electric field until they lose energy by exciting atoms. The production of these high energy electrons is the bottleneck process; once a cesium atom is excited it is rapidly ionized by stepwise excitation. The present calculations represent an extention of previous work (B.Ya. Moyzhes and G.Ye.Pikus, FTT 2,756,1960) in which volume ionization was neglected; the fundamental equations and boundary conditions are quoted from the reference

Card 1/2

L 33163-65

ACCESSION NR: AP5005227

3

cited. A number of simplifications are introduced to make the calculation feasible and the justification of each is discussed. The calculated characteristic for a cathode temperature of 1700°K is monotonic, the transition from the diffusion regime to the arc discharge being signaled merely by a rather sharp bend in the characteristic. At lower cathode temperatures a region of instability occurs in which the current is a three-valued function of potential. The surface ionization of cesium at the electrodes was neglected in the calculations. The effect of surface ionization is discussed in an appendix, and it is concluded that this process can contribute appreciably to the ion current when the cathode temperature is less than 1500°K. "The authors are deeply grateful to G.Ye.Pikus, V.G.Yur'yev and A.M.Martsinovskiy for very valuable discussions and advice during all stages of the work." Orig.art.has: 40 formulas and 3 figures.

ASSOCIATION: none

SUBMITTED: 08May64 ENCL: 00 SUB CODE: ME,EM

NR REF SOV: 010 OTHER: 010

Card 2/2

EPF(c)
L 3973-66 EWT(1)/EPA(s)-2/EWT(m)/EEC(k)-2/ETC/EWG(m)/EPA(w)-2/T/EWP(t)/EWP(b)/EWA(h)

ACCESSION NR: AP5024041 IJP(c) JD/WW/TT/AT UR/0057/65/035/009/1621/1633
537.523.5

AUTHOR: Moyzhes, B. Ya.; Baksht, F. G.; Melikiya, M. G.

77
B

TITLE: On the theory of low-voltage arc in cesium. II

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 35, no. 9, 1965, 1621-1633

TOPIC TAGS: thermionic energy conversion, arc mode, cesium

ABSTRACT: The assumption is made that the concentration and temperature of electrons are sufficiently large to make possible an energy exchange between fast and slow electrons. Under such conditions, when the starting energies are below the excitation threshold, the electron distribution function is close to the Maxwellian. The expression for ion generation and recombination is derived along with formulas for electron-electron collisions and step excitations of atoms due to electron impact. By approximating the unknown functions by polynomials, the solution of the system of differential equations reduces to a system of transcendental equations, the solution of which can be facilitated by neglecting the effect of generation. The formulas derived are used to calculate the volt-ampere characteristics of a low-voltage arc-mode energy converter. Orig. art. has: 41 formulas and 5 figures. [ZL]

Card 1/2

L 3973-66

ACCESSION NR: AP5024041

ASSOCIATION: none

SUBMITTED: 14Nov64 ENCL: 00 SUB CODE: EM

NO REF SOV: 009 OTHER: 008 ATD PRESS: 4118

Card 2/2

L 47035-66 EEC(k)-2/EWT(1)/EWT(m)/T/EWP(t)/ETI IJP(c) RTW/TT/AT/WH/JD

ACC NR: AP6031273 SOURCE CODE: UR/0057/66/036/009/1685/1697

AUTHOR: Dyuzhev, G. A.; Baksht, F. G.; Martsinovskiy, A. M.; Moyzhes, B. Ya.; Pikus, G. Ye.; Yur'yev, V. G.

ORG: none

TITLE: Probe-method investigation of the plasma in thermionic converters with high cesium pressure. III. Distribution of the concentration, the electron temperature, and the space potential in the interelectrode gap of thermionic converters

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 36, no. 9, 1966, 1685-1697

TOPIC TAGS: thermionic energy conversion, direct energy conversion, arc discharge, cesium electron tube

ABSTRACT: Specially constructed instruments with movable probes were used in extensive investigations of the operation of a cesium-filled thermionic converter. The investigations were carried out at pressures characteristic of both the diffusion and arc modes. The measurements confirm the theory of the diffusion mode advanced in 1960 by Moyzhes and Pikus (Moyzhes, B. Ye., and Pikus, G. Ye., FTT, 2, 756, 1960). They also show that, at low cathode temperatures, the ionization starts in this mode next to the anode in the region of the anode drop. The transition to the arc mode is accompanied by a redistribution of the potential and a shifting of the ionization region toward the cathode. In the arc mode, a substantial part of the applied volt-

Card 1/2

L 47035-66
ACC NR: AP6031273

age drops on the near-cathode barrier and in the region close to the cathode. Next to the anode and in the anode region there is only a small potential barrier, which vanishes with increasing current. The electron temperature in the gap appears to be almost constant, although it increases slowly with increasing current. At the same time, the carrier concentration increases rapidly when current increases. The values of electron concentration and temperature obtained by the authors agree with those obtained by other researchers in spectral measurements. While they consider their method highly useful and accurate, the authors concede that, unlike optical methods, it does not yield information on the degree of equilibrium in the plasma. Orig. art. has: 9 formulas, 10 figures, and 2 tables. [ZL]

SUB CODE: 20/ SUBM DATE: 04Sep65/ ORIG REF: 009/ OTH REF: 007/ ATD PRESS: 5089

Card 2/2

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R001135510001-4"

L 01257-67 EWT(l)/EWT(m)/EWP(t)/ETI IJP(c) JD

ACC NR: AP6031031 SOURCE CODE: UR/0109/66/011/009/1666/1673

AUTHOR: Krasin'kova, M. V.; Moyzhes, B. Ya.; Shklyar, A. G.

ORG: none

TITLE Electric and emission properties of (CaSr)O

SOURCE: Radiotekhnika i elektronika, v. 11, no. 9, 1966, 1666-1673

TOPIC TAGS: calcium strontium oxide, resistivity, thermal emf, work function, thermionic emission, emission property, electric property

ABSTRACT: The temperature dependence of resistivity, the thermal emf coefficient and variation in resistance in the magnetic field of porous (CaSr)O is investigated over the temperature range of 300—1250K. The data obtained confirm the hypothesis on the presence at high temperatures, due to thermal emission from the walls, of electric conductivity along the pores filled with electron gas. An agreement was obtained for the values of the electron work function in the pores of the coating which was calculated from thermal emf and of the values of electric conductivity over the temperature range of 800—1250K. The electron work func-

Card 1/2 UDC: 621.385.735

L 01257-67

ACC NR: AP6031031

0

tion from the external surface of the oxide was determined from the results of measurements of the thermal emission under saturation conditions over the temperature range of 400—1150K. An agreement was obtained for the electron work function from the external surface of the oxide and the electron work function into the pores. The plate work function in tubes using (CaSr)O cathodes was determined. Its value is higher by 0.5—0.6 ev than in the case of (BaSr)O cathodes in identical tubes. Orig. art. has: 7 figures, 7 formulas and a bibliography of 7 titles. [Authors' abstract] [DW]

SUB CODE: 07, 09/ SUBM DATE: 31Mar65/ ORIG REF: 004/ OTH REF: 003/

hs

Card 2/2

L 01211-67 EWT(1)/EWP(e)/EWT(m)/EWP(t)/ETI IJP(c) JD/WW/WH

ACC NR: AP6031032 SOURCE CODE: UR/0109/66/011/009/1674/1681

56
B

AUTHOR: Moyzhes, B. Ya.; Petrov, I. N.; Sorokin, I. V.; Sher, E. M.

ORG: none

TITLE: Measurement of the heat conductivity of an oxide coating at operating temperatures of the cathode

SOURCE: Radiotekhnika i elektronika, v. 11, no. 9, 1966, 1674-1681

TOPIC TAGS: heat conductivity, oxide coating, cathode coating

ABSTRACT: A procedure is developed for measuring the heat conductivity coefficient of porous oxide coatings ($\varkappa_{ox}$) transparent for heat radiation at the operating temperature of the cathode ($\sim$ 1000K). For layers deposited by spraying, $\varkappa_{ox}$ was found to be within $(1.5\text{--}8) \cdot 10^{-6}$ w/cm degrees. The low heat conductivity promotes substantial preheat of the oxide layer, especially with pulsed pickoff of current from the cathode. A comparison was made of $\varkappa_{ox}$ values obtained with this procedure with the measurement made on the same specimen at a temperature close to room temperature and the results are given. Orig. art. has: 5 figures, 3 tables, 11 formulas and 4 bibliographic references. [Authors' abstract] [DW]

SUB CODE: SUBM DATE: 31Mar65/ORIG REF: 002/ OTH REF: 002/

Card 1/1 blg UDC: 621.385.735:536.2.08

L 04609-67 EWT(1)/T IJP(c) AT

ACC NR: AP6033429 SOURCE CODE: UR/0057/66/036/010/1901/1904

AUTHOR: Kaplan, V. B.; Moyzhes, B. Ya.; Pikus, G. Ye.; Shakhnazarova, G. A.; Yur'yev, V. G.

ORG: Institute of Semiconductors, AN SSSR, Leningrad (Institut poluprovodnikov AN SSSR)

9c

B

TITLE: Spectroscopic measurements of the plasma parameters of a thermionic converter

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 36, no. 10, 1966, 1901-1904

TOPIC TAGS: thermionic energy conversion, arc discharge, plasma arc, plasma dynamics, plasma diffusion, spectroscopy

21

ABSTRACT: The plasma parameters (concentration, electron temperature, proportion of excited atoms, etc.) in an arc-mode thermionic converter were optically determined by means of a mirror monochromator with photoelectric registration and potentiometric recording. Care was taken to exclude from the treatment the long-wave lines of the P-D and F-D transitions, which showed significant adsorption, and to eliminate the cathode illumination while the measurements of the continuum intensity were being taken. The investigations were made at cathode temperatures from 1100 to 1600K and at cesium vapor pressures from 0.4 to 2.0 mm hg. The interelectrode distances varied from 1 to 2.0 mm. The investigation demonstrated that the electron temperature decreases monotonically between the cathode and anode. The maximum of the electron

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ACC NR: AP6033429

concentration was found at a distance of 0.3 mm from the cathode. It was also found that the distribution of the excited atom concentration does not follow the changes of the electron temperature. The transition from generation to recombination takes place close to the point at which the temperature and line intensity curves intersect. If it is assumed that at this point neither generation nor recombination occurs, then the concentration of electrons and excited atoms at this point should be close to the thermodynamic equilibrium. At T_e = 2500K, the thermodynamic concentration should be 1.25×10^{14} cm^{-3} (the measured concentration was 7×10^{13} cm^{-3}). From their own calculations and a discussion of the less pronounced changes of the electron temperature registered by other researchers using the probe method, the authors conclude that the plasma of a thermionic converter operating under the investigated conditions is essentially of the nonequilibrium type. Orig. art. has: 2 formulas and 3 figures.

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Card 2/2 egh

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AUTHOR: Dyuzhev, G. A.; Martsinovskiy, A. M.; Moyzhes, B. Ya.; Pikus, G. Ye.; Tsirkel', B. I.; Yur'yev, V. G.

ORG: none

TITLE: Plasma sounding in thermoemission converters with high pressure cesium vapors. I. Experimental methods and theory

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 36, no. 4, 1966, 679-691

TOPIC TAGS: plasma arc, plasma probe, thermoelectric converter, cesium plasma

ABSTRACT: The equipment for the probing of an isothermal plasma and the experimental data processing are described for the case of a thermoemission converter with high-pressure cesium vapors and small interelectrode gaps. Movable molybdenum probes 0.2 mm in diameter and 7--8 mm long were used. A detailed description of the construction of the probes is given. The measurements were carried out at 1200 and 1900°K cathode temperatures and 10^{-1}--4.0 mm Hg cesium vapor pressures with the cathode and vapor temperature stability of $\pm 2°$ and $\pm 0.5°$, respectively. The theory of probes in a high-density plasma and the method of processing the probe characteris-

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tics are analyzed. Formulas are derived on the concentration, carrier temperature, and the potential distribution in a thermoemission converter in which the plasma is generated by the arc. Orig. art. has: 2 figures and 46 formulas.

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AUTHOR: Dyuzhev, G. A.; Martsinovskiy, A. M.; Moyzhes, B. Ya.; Pikus, G. Ye.; Yur'yev, V. G.

ORG: none

TITLE: Plasma sounding in thermoemission converters with high-pressure cesium vapors. II. Verification of the probe method. Certain experimental results obtained in the diffusion and arc modes

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 36, no. 4, 1966, 692-703

TOPIC TAGS: plasma probe, plasma arc, plasma diffusion, thermoelectric converter, cesium plasma

ABSTRACT: This paper is a continuation of the theoretical work on the plasma probing which appeared in the same issue of ZhTF (pp. 679-691). The equipment and the data processing methods were checked experimentally using an isothermal plasma which was diffusion- or arc- generated in an interelectrode gap of a thermoemission converter with high-pressure cesium vapor. The experimental results show that in an isothermal plasma with known parameters, the probing method yields data on the electron concentration and the space potential when the length of the free path is smaller

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than the probe dimensions. In this connection, elevated values of electron temperature were obtained. The divergence is due to a large th rmoelectron emission of the probe and a slow energy transfer between the fast and slow electrons. Measurements carried out in the diffusion mode are in agreement with theory presented elsewhere (Moyzhes, B. Ya., and G. Ye. Pikus, FTT, 2, 756, 1960). Measurements carried out in the arc mode indicate that the cesium plasma generated between the electrodes of a thermoemission converter differs greatly from a plasma in conventional gas-discharge equipment. The electron temperature is low, approximately 2500°K at all the test points of a v-a curve, and the ionization does not exceed 1%. The fact that a plasma in a thermoemission converter remians sufficiently cold can be used to achieve high-efficiency conversion of thermal to electrical energy. The experimental values of the electron temperature and concentration for the arc mode are essentially in agreement with those calculated and presented by Moyzhes et al. (ZhTF, 35, 1621, 1965). In general, the measurements in an isothermal plasma show that the experimental equipment and methods used have yielded satisfactory results and can be used in a study of nonisothermal plasma. The authors thank Yu. M. Kagan, V. I. Perel', and F. G. Bakshta for useful evaluation of results and for valuable advice. The authors thank Yu. M. Kagan, V. I. Perele, and F. G. Baksht for useful discussions and valuable advice. Orig. art. has: 12 figures and 1 table.

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MOYZHES, B.Ya.

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(Blast furnaces)